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COST OF USING
HORSES

on
Corn-Belt Farms



The following series of six bulletins has been prepared under the direction of the Committee on Farm Power, appointed by the Secretary of Agriculture, to represent the Bureau of Agricultural Economics, Bureau of Public Roads, and the Bureau of Animal Industry, in a cooperative study of all phases of the farm-power problem:

Farmers' Bulletin 1295: What Tractors and Horses Do on Corn-Belt Farms.

Farmers' Bulletin 1296: Changes Effected by Tractors on Corn-Belt Farms.

Farmers' Bulletin 1297: Cost of Using Tractors on Corn-Belt Farms.

Farmers' Bulletin 1298: Cost of Using Horses on Corn-Belt Farms.

Farmers' Bulletin 1299: Shall I Buy a Tractor? (For a Corn-Belt Farm.)

Farmers' Bulletin 1300: Choosing a Tractor. (For a Corn-Belt Farm.)

This bulletin, which is No. 4 of the series, shows the cost of keeping horses on Corn-Belt farms and the cost of the power which they furnish, and discusses the possibilities of reducing these costs.

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COST OF USING HORSES ON CORN-BELT FARMS.

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VARIOUS INVESTIGATIONS by the United States Department of Agriculture have shown that the maintenance of work horses is one of the heavy expenses in the cost of producing farm products. The fact that much of the expense of keeping work stock is made up of feed produced on the farm and other expenses which are not direct cash outlays may have caused a tendency to accept this yearly expense without careful consideration of the extent of the cost involved, or of the possibility of reducing this expense. However, the cost of using horses has a direct bearing on the total farm profit and is of great enough importance to warrant careful consideration by every farmer.

The purpose of this bulletin is to present information on the cost of using horses in the Corn Belt that will acquaint the farmer with the extent of this yearly expense and suggest methods by which this item may be reduced on many farms.

IMPORTANCE OF HORSEPOWER COSTS.

According to the United States Department of Agriculture, on January 1, 1921, there were on the farms of the United States 24,663,000 horses and mules, with a total valuation of \$2,255,991,000. These animals were raised and are maintained primarily for the purpose of furnishing farm motive power.

The gross cost of keeping the work stock is made up of feed and bedding, labor, interest, stabling, use of harness, shoeing, depreciation, and miscellaneous charges. The gross charge is partially offset by the manure produced, the resulting net cost being, of course, the cost of the work performed by the horses.

Prior to the late war—1914 to 1918—the annual cost of keeping work horses on Corn-Belt farms of approximately 160 acres usually amounted to from \$450 to \$750 per year. During the war this cost

increased along with other things until the peak was probably reached in the early part of 1920. During the latter part of 1920 feed prices began to decline and by the end of 1921 had fallen to such an extent that the average cost of keeping horses for 1921 was about 60 per cent of that for 1920 and about 110 per cent of the prewar cost. The present indications (September, 1922) are that the 1922 average cost of keeping horses in the Corn Belt will even more nearly approach the prewar costs. Before the war the average cost of horsepower on Corn-Belt farms where tractors were not used was around 9 or 10 cents per hour of work. During 1920, the average cost was about 20 cents per hour, and during 1921 around 11 or 12 cents per hour. The effect of variations in the average cost per hour of work on the cost of the power required to produce an acre of corn, oats, and hay is illustrated in Table 1.

TABLE 1.—Effect of the rate per hour on the cost of horsepower per acre.

Crop.	Cost of power per acre with horse rate at—			
	10 cents.	15 cents.	20 cents.	25 cents.
Corn from standing stalk.....	\$4.60	\$6.95	\$9.25	\$11.60
Oats.....	1.75	2.65	3.50	4.40
Mixed hay.....	1.00	1.50	2.00	2.50

About 45 per cent of the total operating expense¹ of growing an acre of corn is for horsepower (Dept. Bul. 1000, "Labor and Material Requirements of Field Crops"). With the cost of horsepower at 11 to 12 cents per hour, and with corn at 50 cents per bushel, 10 or 11 bushels of corn are required to pay this expense on each acre produced. In growing oats about 25 per cent of the operating expense is for horsepower, and in the production of hay about 20 per cent of the operating expense is for this item.

It is clear, therefore, that the cost of using horses is an important item in operating a farm, and that a considerable part of each of the above-mentioned crops is required to pay for the power used in their production.

On some farms the horse cost per hour or day is two or three times what it is on others. Such wide variations on individual farms suggest possibilities of lowering this expense, and thereby reducing the cost of crop and livestock production. Obviously those who are interested in the economical production of farm products should consider carefully the efficient utilization of horses for power and the means of reducing this expense.

COST OF KEEPING WORK HORSES.

The United States Department of Agriculture has always given particular attention to the bushels of grain, tons of roughage, hours of labor, etc., used in the maintenance of farm work horses. Information of this kind has been obtained at different times from

¹ "Operating expense" refers to all commonly accepted items of production expense, excluding interest on land value.

Corn-Belt farmers in Western Ohio, Indiana, Illinois, and Iowa, over a period of 12 years, from 1909 to 1920. With the quantity requirements available, the approximate cost of keeping a horse has been computed for 1921 by applying the current average prices to the quantities obtained from 279 farms.² By this method of procedure have been obtained the general averages shown in Table 2.

TABLE 2.—*Itemized summary of average annual costs and relative importance of various items of cost, 1921.*

[279 farms, 1,975 horses.]

Items.	Cost per horse.	Per cent of total cost.
Feed and bedding ¹	\$63.88	60.2
Chores.....	11.88	11.2
Depreciation.....	6.70	6.3
Interest.....	7.37	6.9
Stabling.....	7.28	6.9
Harness costs.....	4.78	4.5
Shoeing.....	1.90	1.8
Miscellaneous.....	2.29	2.2
Total gross cost.....	106.08	100.0
Credit for manure.....	6.87	
Net cost.....	99.21	

¹ The item of bedding is included with feed, because on many farms straw and stover were used both as feed and bedding, and owing to the fact that refuse from the manure was used for bedding, it was contrary to actual practice to attempt to make bedding a separate item. In the following pages, all references to feed include both feed and bedding.

The 279 farms averaged about 200 crop acres per farm, and the cost of keeping the work stock amounted to \$702 per farm. However, the majority of these farmers used tractors as well as horses, and consequently the \$702 does not represent the entire average cost of motive power per farm. Were all of these farms operated with horses alone at a cost of \$99.21 per head, the 1921 average cost of keeping the horses would be nearly \$900 per farm instead of \$702.

On smaller farms the average cost of horse power would, of course, be considerably less than \$900 per year and at the same rate per head would amount to around \$400 annually on a 4-horse farm, \$500 on a 5-horse farm, and so on at an increase of about \$100 for each horse kept. In attempting to arrive at methods for reducing this expense it is first necessary to find out what are the various items of cost and the relative importance of each. Some of the cost items are of minor importance; others are of great importance and sug-

² The 279 farms are located as follows: 32 in Madison County, Ohio; 23 in Seneca County, Ohio; 22 in Madison County, Ind.; 56 in Montgomery County, Ind.; 60 in Livingston County, Ill.; 60 in Knox County, Ill.; 18 in four counties in western Illinois; and 8 in Iowa County, Iowa.

The average prices used in computing the 1921 feed costs were as follows:

Corn, per bushel.—Ohio, 56 cents; Indiana, 50 cents; Illinois, 50 cents; Iowa, 41 cents.

Oats, per bushel.—Ohio, 38 cents; Indiana, 34 cents; Illinois, 33 cents; Iowa, 28 cents.

Hay, per ton.—Ohio, \$13.20; Indiana, \$14.28; Illinois, \$15.79; Iowa, \$11.32.

Straw, per ton.—Ohio, \$4.50; Indiana, \$4.75; Illinois, \$5.26; Iowa, \$3.80.

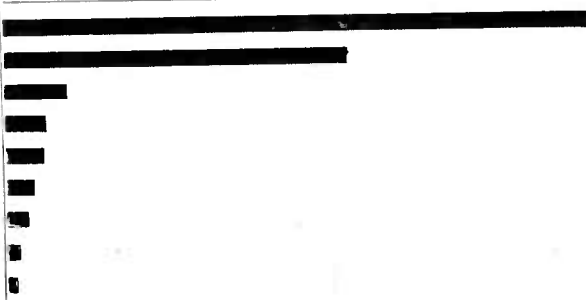
Stover, per ton.—Ohio, \$3.45; Indiana, \$3.60; Illinois, 4.53.

Pasture, per month.—Ohio, \$1.55; Indiana, \$1.50; Illinois, \$1.60; Iowa, \$1.50.

The prices of corn, oats, and hay are the 1921 average farm prices for the States of Ohio, Indiana, Illinois, and Iowa, as reported by the Bureau of Crop Estimates. The prices of straw, stover, and pasture have been obtained by adjusting the prices obtained at the time of the investigation by the percentage of decline or increase in the price of hay since that time.

gest the need for their careful analysis in order to understand how to reduce them.


The following shows graphically the annual cost of keeping horses on a 160-acre farm, and distribution of expenses (6 head, 1921; cost per head, \$99.21):

Item.	Amount.	
Total.....	\$595	
Feed and bedding.....	358	
Chores.....	67	
Interest.....	41	
Stabling.....	41	
Depreciation.....	37	
Harness costs.....	27	
Miscellaneous.....	13	
Shoeing.....	11	

FEED AND BEDDING.

The average cost of feed and bedding amounted to about \$64 per horse, which was slightly over 60 per cent of the total gross cost in 1921. During the recent period of high prices—1918 to 1920—feed prices advanced relatively more than many of the other items and during this period the cost of feed was around 70 per cent of the total. Thus feed and bedding is the largest item in the maintenance of a horse, and hence deserves first consideration in an attempt to reduce costs. That is to say, on farms where there is any chance for a reduction of horse costs, this item will usually offer greatest opportunity.

Exclusive of pasture, the average annual ration on the 279 farms consisted of 40 bushels of corn, 26 bushels of oats, 1.3 tons of hay, and 1.8 tons of straw and corn stover per head. This ration is probably somewhat lower than the average amount of feed consumed by horses on farms where tractors are not owned in these same areas. When the farms were classified according to the yearly amount of grain fed per horse, it was found that there was considerable variation:

Grain per horse.	Number of farms.
Less than 2,000 pounds.....	 (67)
2,000 to 2,999 pounds.....	(91)
3,000 to 3,999 pounds.....	(59)
4,000 to 4,999 pounds.....	(40)
5,000 pounds and over.....	(22)

On horse-operated farms the horses are in constant use during the spring season of heavy work, while on farms where tractors are owned it is at such times that the horses will be idle, kept on pasture, or receive a light ration of grain and hay. Even on farms where tractors were used the amount of grain varied on individual farms from less than 2,000 pounds to more than 5,000 pounds per head. The tendency, however, was toward the lower figure, with over half of the farmers feeding an annual grain ration of less than 3,000 pounds per horse. Of the 26 records for farms on which horses alone were used for motive power, the grain ration ranged from 2,000 pounds to over 6,000 pounds per head, with a tendency toward the higher groups. These data on nontractor farms, while few in number, suggest a decided tendency toward heavier grain feeding on farms where horses alone are used.

The fact that some farmers fed two or three times as many bushels of corn and oats as others indicates that the horses on some farms are overfed and considerable feed is wasted. This condition is partly due to the fact that the farmers in these districts grow their horse feed, and since it is not purchased many do not realize the extent of this expense, nor the minimum amounts of grain and roughage necessary to keep a horse in good shape under various working conditions. This tendency to overfeed is probably less pronounced when feed prices are high or when the amount of feed produced is limited.

Some variations in feeding practices would be expected because of variations in the amount of work performed per horse, and in general there was a tendency for the annual grain ration to increase or decrease as the yearly amount of work increased or decreased. However, on some farms this tendency was not apparent, which suggests that there is considerable opportunity for reducing horse costs by giving some attention to feeding in accordance with the amount and nature of the work done by the horses. For example, on two farms located in western Illinois the horses worked practically the same number of hours per head but the feed cost on one farm was 65 per cent greater than on the other, being \$94 per head on farm No. 1 and \$57 per head on farm No. 2.

There was considerable variation in the yearly amounts of roughage and pasture used on individual farms, and many feeders of a high grain ration used as many tons of roughage and days of pasture per head as did those who fed a light grain ration. On a number of farms little hay was produced, and the horses were wintered on straw and corn stover. In such cases the tons of roughage per horse were relatively high, but the cost was relatively low.

SUGGESTIONS FOR BETTER FEEDING PRACTICES.

Approved methods of feeding work stock should have first consideration on a well-managed farm. The quantity of grain and hay for the work horse depends on the kind and regularity of work done, speed at which the work is performed, quality of the feed, age and condition of the horse, and on the individual animal. Although the exact quantity is variable, a good, practical guide for the farmer to follow in feeding his horses is to allow 1.1 pounds of grain and

1½ pounds of hay per 100 pounds of live weight for horses at moderate work. For horses at hard work the grain should be increased to about 1½ pounds daily per 100 pounds live weight, but the hay should not exceed 1½ pounds daily per 100 pounds live weight, unless of very poor quality. On the farms surveyed the average weight of horses was 1,340 pounds. For horses of this weight Table 3 indicates the approximate quantities of grain and hay which should be fed to horses during various periods of the year.

TABLE 3.—*Approximate grain and hay requirements for a horse when not on pasture.*

[1,300 to 1,400 pound horse.]

Period.	Daily ration of —	
	Grain.	Hay.
	Pounds.	Pounds.
Maintenance (during winter).....	6 to 7	15 to 17
Light work (light hauling and miscellaneous farm work).....	13 to 14	13 to 14
Medium work (cultivating corn, etc.).....	14½ to 15½	16½ to 17½
Heavy work (plowing, diskings, etc.).....	16½ to 17½	16½ to 17½

† Partly unsalable roughages.

The amount of feed required by horses varies, not only from season to season, but also from day to day. Just because four horses are being used at heavy work does not mean that all the horses should receive a similar heavy grain ration. It is the little daily reduction of grain that counts up for a large saving during the year, and these feeding practices assist greatly in keeping the horse in working condition.

During the winter, horses should be fed a light grain ration. As the spring work season opens up the amount of grain must be gradually increased so that the horses are ready to receive a full grain ration when the heavy work begins. During the working season the horse requires a comparatively large amount of grain, the exact quantity depending in general upon the nature of the work performed. (See Fig. 1.)

Aside from the idle winter season, there are times during the summer when at least a part of the horses are not working. During such periods the use of good pasture in place of the grain and hay ration is not only an economical practice, but also will have a good effect upon the system of the horse. If the pasture is short or of poor quality it may be necessary to feed a small amount of grain in order to keep the horse in good flesh.

When the horse is on night pasture and worked during the day, the regular grain ration should be fed, depending upon the nature of the work. If the pasture is good the horse will consume only a small amount of hay and if a large amount is kept in the manger he will only pick out the best, while a considerable part will be pulled out and wasted under foot. At all times the horse should be fed so that he will utilize all the feed put before him, which will aid directly in reducing costs by the prevention of waste.

Many farmers are prodigal in the feeding of hay. It is a common practice for the farmers in the Corn Belt to keep the manger filled

with hay at all times. This is not only a serious waste but it is also detrimental to the health of the horse. The horse has a relatively small stomach, and therefore can not take care of great quantities of roughage during the working season. Excessive feeding of hay to the horse prior to work has a bad effect on the respiratory and digestive systems, and is the cause of excessive sweating and fatigue. Only a small amount of hay should be fed to horses at the morning and noon meals; the greatest amount being fed at night.

The use of nonsalable feed for the horses is to be recommended. When the farming practices are such that good straw, corn stover, and stalk pasture are available, their use will often help to reduce the feed expense, and also permit of the sale of hay or its use as feed



FIG. 1.—Work stock doing heavy work require a comparatively large amount of grain.

for other live stock. The practice of letting the horses have the run of the straw stack and stalk field during the fall and winter not only results in the saving of more valuable feeds but tends to make the animals more hardy and puts them in better shape for spring work.

To obtain the best results in feeding, the ration should be balanced properly to meet the demands of the animal in building tissue and supplying energy for work. If feeds deficient in tissue-building materials (protein) are fed, a large amount of feed must be consumed in order that the required amount of protein is obtained. A little time spent in the calculation of rations enables the feeder to provide the proper amount of nutrients which will be of benefit to the horses and may reduce the feed bill. (For detailed information regarding the calculation of rations and feeding horses consult *Farmers' Bulletin 1030, "Feeding Horses,"* which may be obtained free on application.)

CHORES.

On the 279 farms the total time spent in feeding and caring for an average of seven work horses amounted to 467 hours per farm for the year, or about 66 hours per head. The horses on these farms were used an average of 723 hours per year. On farms where horses are worked to a greater extent the annual amount of man labor for taking care of them is greater and usually varies from 75 to 125 hours per head. At 18 cents per hour, the annual cost of chores on the 279 farms amounted to nearly \$12 per head, or approximately 11 per cent of the total gross cost of keeping a horse.

Chores are nearly always done either by the farmer himself, members of his family, or by the regular labor, without an actual cash outlay, and at least a considerable part of this time would not be profitably employed otherwise. The opportunity for reducing this expense is not great, except where farms are overstocked. Some reduction can be made and satisfaction obtained for the operator and hired help by having convenient feeding and stabling arrangements.

DEPRECIATION.

The net decrease, or depreciation, in the inventory values of work stock on the farms covered in this investigation amounted to \$6.70 per head per year, or about \$47.50 per farm. The cost of replacing worn-out work stock is an item from which there is no escape, although individual farmers may often avoid this expense by the use of young horses, which they sell before depreciation begins. The general principle of depreciation is not changed, however, as this expense is simply passed on to the buyer. It is generally considered that the average work life of a horse is from 10 to 12 years. On some farms the work stock is purchased and the annual depreciation may sometimes reach as high as \$20 to \$25 per horse, especially if deaths occur when horse values are high.

The item of depreciation is lessened on many farms by the raising of colts. (See Fig. 2.) In such cases the cost of horse replacement is the cost of growing and breaking colts for work stock instead of the cash outlay for work horses. Colts increase rapidly in value and continue to increase after broken for work, until the highest value is reached at about the age of 7 years. Thus there will be little or no depreciation other than that caused by disease or injury until the horses are from 7 to 8 years of age. At the time of the investigations there was an appreciation in the total value of the work stock on some of the farms surveyed.

On many farms the power requirements are such that some of the necessary work stock are idle a part of the year. Under such conditions part of the work stock may well be mares that are producing foals. The number of colts produced in this manner is often great enough to replace all worn-out animals and provide a surplus for sale. This surplus may be disposed of to other farmers and to buyers for the city market.

The production of good colts at low cost depends largely upon the ability of the farmer as a manager and a horseman. Colts of greater value will be produced if care is exercised in the selection of the

breeding stock and good husbandry methods practiced in the development of the colts. Since the use of brood mares as work animals imposes double duty on them, it is essential that these mares be rugged and sound and be given the right sort of care.

If horses are raised for sale, all factors in production and development should be carefully considered, so that such points as general conformation, quality, condition, and soundness are of the standard desired by the buyer.

Approved methods of feeding and general management of the work stock so that they are kept in good health is also an important factor in reducing the depreciation charges. Overheating and overworking the horses and lack of proper attention often make them

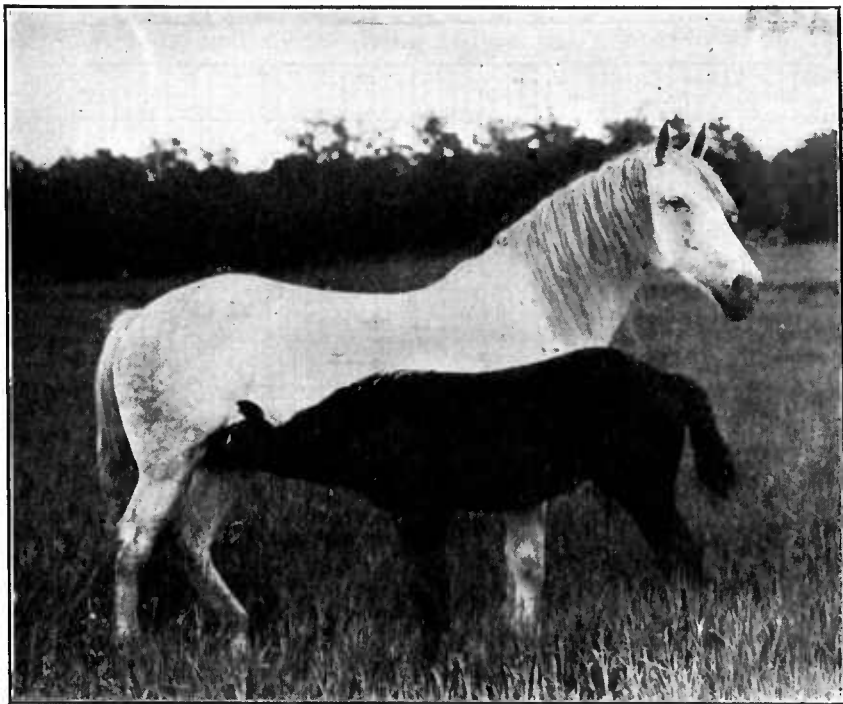


FIG. 2.—The raising of colts to take the place of wornout work stock will often aid in keeping down the depreciation cost.

unfit for hard work at a time when their services are greatly needed, and may cause permanent injury and death. Horses should be fitted for the heavy work season so that they will be in good condition and thereby increase their efficiency and ability to do a full day's work.

INTEREST.

In computing the cost of keeping work stock interest at 6 per cent on the average value of the horses was included. The Bureau of Crop Estimates, United States Department of Agriculture, has published figures on the average farm values of all horses on farms January 1 of each year since 1867 to date. During this period farm

horses were lowest in value in 1897, when the average was less than \$32 per head. After 1897 there was a gradual increase in horse values until 1911, when the peak was reached at a value of nearly \$112 per head. Since 1911 there has been a gradual but more or less irregular decline in horse values until on January 1, 1922, the average value was about \$71 per head. (See Fig. 3.)

The figures on farm prices are averages for all horses on farms and are much lower than the average value of work stock on which the interest charge has been computed. The average farm price of the work horses on the farms visited was nearly \$144 in 1920 and about \$123 in 1921. Aside from the influence caused by variations in horse prices, a reduction in the interest charge per horse can be affected only through the keeping of cheaper horses, but obviously the lower-

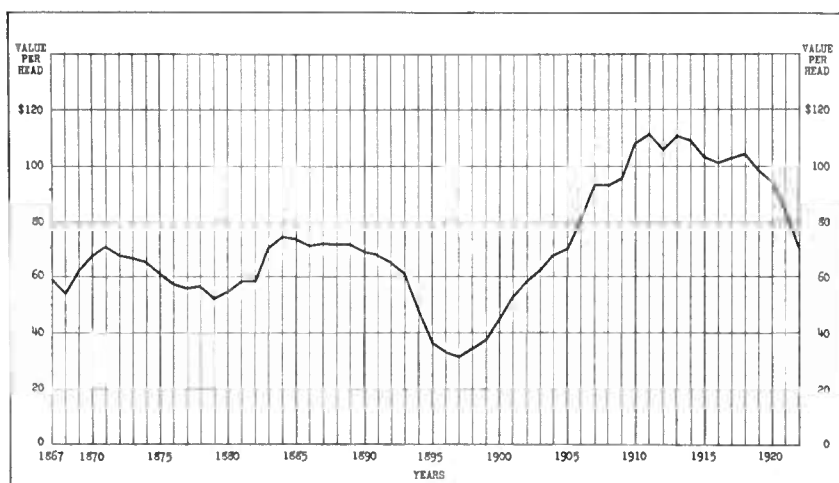


FIG. 3.—Average value of farm horses in the United States, January 1, 1867, to January 1, 1922.

ing of the quality of the horses is unwise and would result in greater expense in many ways. Where farms are overstocked, a reduction in the total charge can be made by selling the surplus horses.

STABLING.

Stabling cost concerns only that part of the building used for stabling horses and storing horse feed. The cost is made up of interest on the average investment, insurance, taxes, cash and labor for repairs, and depreciation. On farms having low-priced buildings, the cost of sheltering the horse is a small item; on other farms where the buildings are expensive it is sometimes an important item of expense.

Table 2 shows that the average cost of stabling horses in the Corn Belt for 1921 was slightly over \$7 per head, or about 7 per cent of the total annual cost of keeping the horse. A small part of this expense represents a direct cash outlay. Attention to the economical construction and maintenance of barns is necessary in order that this item is not disproportionately large.

HARNESS COSTS.

The maintenance cost of harness and other miscellaneous horse equipment, as blankets, etc., becomes properly a part of the cost of horsepower, since this equipment is a necessity where any farm work is performed. It is an item generally of small importance and is made up of the cost of repairs, interest, depreciation, taxes, and insurance on the part of the equipment used by the horses.

According to Table 2, this item in the Corn Belt amounted to \$4.78 per head for the year 1921. This cost would probably be higher where farmers bought harness during the recent period of high prices, and with the lowering of prices the annual cost of maintenance should be somewhat reduced. Farmers are often able to keep their harness in good repair by working on it during slack and rainy periods, and by so doing reduce the annual cost of horse equipment to a minimum.

SHOEING.

Shoeing on most farms is a direct cash expense, but usually represents but a small part of the total cost of horsepower. In certain localities part of the horses are kept shod throughout the year; on other farms a horse is scarcely ever shod. In some of the Corn-Belt areas shoeing was not at all general, while in others the cost averaged between \$3 and \$4 per head, with much greater costs on individual farms. The average for all farms visited was about \$2 per head in 1921.

MISCELLANEOUS COSTS.

This item is composed of insurance and taxes on horses, veterinary services, medicine and drugs, salt, etc. It represents a direct cash outlay, and the total amount is generally influenced more by the amount expended for veterinary services than by any other item. According to Table 2, miscellaneous costs averaged \$2.29 per head. On some farms this item was practically negligible for the year of the study, while on others where sickness or injury occurred it was large.

MANURE CREDIT.

In computing the cost of keeping the work stock an average manure credit of nearly \$7 per head was deducted from the total gross cost to obtain the net cost per farm and per head. On the majority of the farms the manure has no sale value and obviously is not a cash credit. A credit of this nature will vary in amount according to the individual practice of manure management, and according to the extent to which roughage is used for feed and bedding.

CASH COST OF KEEPING WORK STOCK.

Only a part of the items previously discussed can be considered as being either direct cash expenses or as involving materials having a sale value. The corn, oats, and hay consumed were practically all

salable, and in the majority of cases the straw included in the ration could have been sold. Stover and pasture are principally by-products of the farming systems practiced in the Corn Belt and only in few cases could these have been actually sold.

On this basis the value of salable feed figured at average farm prices for 1921 amounted to nearly \$53 per head, or \$374 per farm. This is over 50 per cent less than the value of these feeds in 1920. The amount of nonsalable horse feed varied widely in the eight areas visited. In one area the average value amounted to \$5.25 per head, and in another the average was \$22.30 per head. In the other six districts the average varied from about \$9 to \$12 per head.

Horse chores are mostly done before or after the regular day's work and the cost can not properly be classed as a direct cash outlay. Depreciation of work stock, where the horses are bought to take the place of those going out of the group, is distinctly a cash cost. Where the animals are raised to offset depreciation the cost is largely made up of salable feed and cash items.

Stabling and harness costs are mostly made up of interest on investment, depreciation, and general farm labor and can not be classed as strictly cash outlays.

Shoeing and veterinary costs represent direct cash outlays on most farms.

These actual cash items and salable feeds may be generally thought of as representing "cash costs," or the equivalent of cash. The sum of these, that is corn, oats, hay, straw, depreciation, shoeing, and miscellaneous cash costs, amounted to about \$64 per horse or \$451 per farm, which was about 60 per cent of the total cost for 1921. This percentage would probably be greater during periods of high feed prices but such items are always of great enough importance to repay any attempt to reduce them. Such items as stover and pasture, while considered as noncash costs, are of value in the production of salable live stock and live-stock products. Because of their nature and abundance in some areas, they have a low value and their use when horses are idle will help to reduce costs.

COST OF HORSEPOWER.

The daily or hourly cost of horsepower on any farm is dependent upon the number of work stock kept, the cost of keeping them, and the number of days or hours worked during the year. The cost of keeping a horse varies greatly on different farms. Feed, the principal item, amounts to twice as much on some farms as on others. Also the number of work stock varies considerably on different farms of the same size, and wide differences are found in the number of days the horses work per year. On the 279 farms the average hours worked during the year were 723 per horse, and the average cost of keep was \$99.21 per head. On the basis of 10 hours of work the average cost per day was \$1.37 or 13.7 cents per hour of actual work performed.

Cost per day of using horses and distribution of daily expense (279 farms).

Total.....	\$1.37	
Feed.....	.82	
Chores.....	.15	
Interest.....	.10	
Stabling.....	.10	
Depreciation.....	.09	
Harness costs.....	.06	
Miscellaneous.....	.03	
Shoeing.....	.02	

The variations in the total cost of keeping horses on different farms are almost in direct proportion to the variations in feed costs. In general, the cost per hour is influenced more by the number of hours worked than by the cost of keeping a horse, and the cost per hour or day may be said to decrease with an increase in the amount of work performed. Variations in the amount of work performed per year are illustrated by the following figures for the 279 farms in the Corn Belt:

The horses on—

- 50 farms worked less than 500 hours per year.
- 105 farms between 500 and 699 hours per year.
- 63 farms between 700 and 899 hours per year.
- 33 farms between 900 and 1,099 hours per year.
- 17 farms between 1,100 and 1,299 hours per year.
- 11 farms 1,300 hours and over per year.

Obviously, *if all other things were equal*, the horse that worked 1,300 hours would be less costly to its owner than the horse that worked but 500 hours per year, and so the amount of work per horse and the cost of this work per hour and per day have been extensively used as measures of the efficiency with which horses are maintained and worked on individual farms and in different regions of the country. Many American types of farming are such that some of the horses maintained throughout the year are needed only to perform necessary work during the crop season or at rush periods, so that the amount of work done by a group of farm work horses is not limited so much by their yearly capacity as by the distribution and the amount of the work to be done.

The most profitable combination of enterprises may require a large number of horses for only a short period of the year, even though many of the horses are idle during the greater part of the time. The average hours worked per day or per year under such conditions may be exceptionally low and still it may be the best of management to continue such a form of organization. Even on the same farm there will be a certain amount of variation in the days of horse work required from year to year, owing to changes in the acreages of the various crops, amounts of livestock kept, conditions of weather and soil, crop yield, etc. However, when comparisons are confined to farms within a region like the Corn Belt, where farming practices are much the same, the hours worked per horse and the cost per hour of work are of value as indications of the degree of efficiency with which horses are employed. Such com-

parisons usually show that a part of the farmers in a locality are using their horses more economically than others.

Effect of hours worked per year on cost per hour of work (1913 costs on 2 farms in a Corn-Belt locality)—

Hours worked per horse.	Cost per hour of work.
Farm No. 1.... 643..	(15 cents.)
Farm No. 2.... 1,286..	(9 cents.)

On horse-operated farms the average number of acres of crops tended per horse in different sections of the Corn Belt varies from about 18 to 24. On individual farms within a given locality the variation is even greater. A low number of crop-acres per horse is usually associated with a relatively high cost per acre for the work done, and often indicates that the farm is overstocked with work horses. The keeping of more work stock than is necessary to perform properly the work is almost sure to result in a relatively high cost per acre for power.

Crop acres per horse and cost per crop acre of power (1913 costs on two farms in the same locality)—

Crop acres per horse.	Cost per crop acre.
13.....	(\$7.70).
24.....	(\$4.05).

With the business established the number of horses kept must be adjusted to the nature of the business and form of management developed. A smaller number than are needed properly to carry on the farm operations may mean a decrease in farm profits greater than the expense for carrying the extra animals. A greater number than are needed simply add unnecessary expenses. Where satisfactory arrangements can be made some farmers may find it more profitable to hire extra horses during short rush periods than to keep an extra team to do only a few days' work at such times. The horses on 55 per cent of the 279 farms worked less than 700 hours each per year. On the remaining 45 per cent, a few of the farms averaged as high as 1,200 to 1,500 hours per horse.

Often too many horses are kept because the owner does not realize the extent of the annual cost to keep them, or because individual animals are retained for sentimental reasons. If the work animals so kept are brood mares, this practice may not be objectionable, since by raising a colt each year such animals add to the farm income, aside from the work they perform. On some of the smaller farms an extra horse is often kept for use on the larger-sized machines when certain operations are performed. This extra horse is often idle a good part of the year and increases the total cost of power as well as the cost per hour of work. It must be borne in mind, however, that the total cost of doing most field operations includes the cost of man labor as well as the cost of power, and the expense for keeping the extra horse is at least partially offset by a saving in man labor through the use of the larger implement. Besides the saving in man labor, there is the gain due to being enabled

to cover more acres per day. The difference of a few days during unfavorable weather is often the deciding factor between a good crop and a poor one. The saving of man labor and the ability to do work at the proper time through the use of large equipment and large sized teams are, of course, as important on large farms as on small ones, and must always be considered in connection with the cost of power. (See Fig. 4.)

In general, the keeping of surplus horses is an expensive practice. While it is not possible to keep the work stock at work continuously, nor advisable to do so for the mere sake of keeping the horses busy,



FIG. 4.—Three horses and one man with a 2-row cultivator will do approximately the same amount of work per day as will be done by four horses and two men when using 1-row cultivators.

every farmer should realize that too many horses, or a lack of productive work for them to do, will result in a relatively high cost for their use.

The economical use of horses for power is a question that must be considered in connection with the operation of the entire farm business. The details must be worked out by each farmer to fit his own case, so that they may be applied to the particular conditions under which he farms. So long as horses are maintained throughout the year at a large expense, to work from 20 to 40 per cent of their time, and so long as this cost represents so large a share of farm costs, the question will be one of importance and one which the farmer will always do well to consider.

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